

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-272926

(43)Date of publication of application : 05.10.2001

(51)Int.Cl.

G09F 9/30

H01J 9/24

H01J 29/87

H01J 31/12

(21)Application number : 2000-082849

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(22)Date of filing : 23.03.2000

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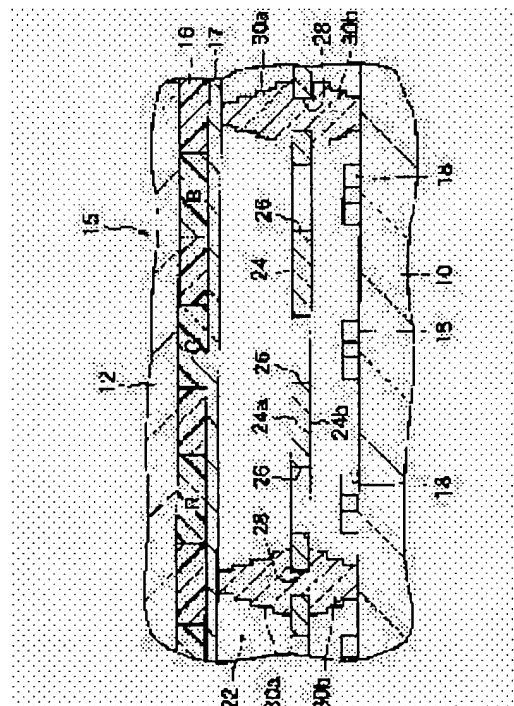
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(54) SPACER ASSEMBLY OF FLAT DISPLAY DEVICE, FLAT DISPLAY DEVICE PROVIDED WITH THE SAME, PRODUCTION METHOD OF SPACER ASSEMBLY AND DIE USED FOR PRODUCTION OF SPACER ASSEMBLY

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a spacer assembly for a flat display device which can be manufactured easily, the flat display device provided with it, a production method of the spacer assembly and a die used for production of the spacer assembly.

SOLUTION: The spacer assembly 22 has first and second spacers 30a and 30b integrally erected and arranged on the first and second surfaces of platy grids 24, respectively. Each spacer has a head-cut conical shape with tapered steps toward a stretching end. The first and second spacers are integrally formed on the grid surface by charging glass paste containing an ultraviolet curing type binder in a through hole of the die, emitting an ultraviolet ray to cure the glass paste and baking the glass paste at a prescribed temperature while holding the die in an adhesion state, after tightly adhering and placing the first and second dies with/on a plurality of through holes of a tapered shape with steps on the first and second surfaces of the grids, respectively.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the metal mold used for the manufacture approach of the flat-surface indicating equipment equipped with the spacer assembly used for a flat-surface indicating equipment, and the spacer assembly, and a spacer assembly, and manufacture of a spacer assembly.

[0002]

[Description of the Prior Art] In recent years, the field emission display (FED), the plasma display (PDP), etc. are known as a flat-surface indicating equipment. Moreover, development of surface conduction mold electron emission equipment (SED is called hereafter) is furthered as a kind of FED.

[0003] This SED has the face plate and rear plate by which placed the predetermined clearance and opposite arrangement was carried out, and these plates constitute the vacuum envelope by joining the periphery section mutually through a rectangle frame-like side attachment wall. The fluorescent substance layer of three colors is formed in the inside of a face plate, and many emitters which correspond to the inside of a rear plate for every pixel as a source of electron emission which excites a fluorescent substance are arranged. Each emitter consists of the electron emission section, an electrode of the pair which impresses an electrical potential difference to this electron emission section, etc.

[0004] Moreover, a tabular grid is arranged among both plates, and while convergence puncturing of a large number which aligned to the emitter at this grid and were located is formed, many pillar-shaped spacers for maintaining the clearance between plates are arranged. And it converges the electron beam emitted from each emitter on a desired fluorescent substance layer through puncturing to which a grid corresponds.

[0005] As SED equipped with the spacer assembly which consists of the above grids and spacers, what was indicated by U.S. Pat. No. 5,846,205 is known. According to this SED, it has much spacer puncturing, the spacer of the shape of a small column of a path is slightly inserted in each spacer puncturing rather than spacer puncturing, and adhesion immobilization of the tabular grid is carried out with adhesives, frit glass, solder, etc. at the grid. And each spacer is in contact of a projection from both sides of a grid, and the both ends are in contact with the inside of a face plate and a rear plate, respectively.

[0006]

[Problem(s) to be Solved by the Invention] However, as mentioned above, a pillar-shaped spacer is inserted in spacer puncturing of a large number formed in the grid, respectively, and when manufacturing a spacer assembly by fixing using adhesives etc., while manufacture is very troublesome, it becomes difficult to aim at improvement in manufacture effectiveness. That is, the diameter number of 100 micrometers, height of several mm, and spacer puncturing corresponding to [it is very small and] this of each spacer are also very small. And such a thing that a small spacer is correctly inserted in in spacer puncturing of a grid very much, and is done for adhesion immobilization at a grid using adhesives etc. needs a high assembly precision, and it causes decline in a manufacture increase in cost and manufacture effectiveness while an activity is very difficult.

[0007] This invention was made in view of the above point, and that purpose is in offering the metal mold used for the manufacture approach of the flat-surface indicating equipment easily equipped with the spacer assembly of the flat-surface indicating equipment which can be manufactured, and the spacer assembly, and a spacer assembly, and manufacture of a spacer assembly.

[0008]

[Means for Solving the Problem] The spacer assembly which starts this invention in order to attain the above-mentioned purpose is equipped with a substrate and the spacer of the shape of two or more column set up in one on

the substrate, while the laminating of each spacer is carried out toward the extension edge from the above-mentioned substrate, it has in one two or more steps to which the path became small gradually, and each step is characterized by being formed in the shape of [of a taper] a taper toward extension one end from the substrate side.

[0009] Moreover, the spacer assembly concerning this invention A tabular grid with convergence puncturing of plurality [list / which countered / the 1st and 2nd front faces and list], The 1st spacer of the shape of two or more column set up in one on the 1st front face of the above-mentioned grid, It has the 2nd spacer of the shape of two or more column set up in one on the 2nd front face of the above-mentioned grid. Each of the 1st and 2nd spacers of the above While the laminating is carried out toward the extension edge from the above-mentioned grid, it has in one two or more steps to which the path became small gradually, and each step is characterized by being formed in the shape of [of a taper] a taper toward extension one end.

[0010] Furthermore, the 1st substrate with which, as for the flat-surface display concerning this invention, the fluorescent substance layer was formed in the inside, The 2nd substrate with which a fluorescent substance excitation means to excite the above-mentioned fluorescent substance layer was established while placing the 1st substrate of the above, and a predetermined clearance and carrying out opposite arrangement, It has the side attachment wall of the shape of a frame which joined the periphery section comrade of the 1st and 2nd substrates of the above, and the above 1st and the spacer assembly prepared in the wooden floor the 2nd set. And a tabular grid with convergence puncturing of a large number to which the above-mentioned spacer assembly countered the above-mentioned fluorescent substance excitation means, respectively, It has the spacer of the shape of two or more column set up in one on the above-mentioned grid. Each spacer While the laminating is carried out toward the extension edge from the above-mentioned grid, it has in one two or more steps to which the path became small gradually, and each step is characterized by being formed in the shape of [of a taper] a taper toward extension one end.

[0011] While having in one two or more steps to which the path became small gradually while the laminating of each spacer was carried out toward the extension edge according to the spacer assembly and flat-surface display which were constituted as mentioned above, each step is making nothing and a taper configuration with a stage as a whole, i.e., a truncated cone configuration almost with a stage, for the shape of a taper of a taper toward extension one end. Therefore, it becomes possible to make two or more spacers in one on a substrate or a grid by mold etc., and the spacer assembly and flat-surface display which can be manufactured can be obtained easily.

[0012] The manufacture approach of the spacer assembly concerning this invention So that tabular metal mold with two or more bores of the shape of a taper with a stage to which the path became small gradually respectively toward an end side to the other end side with the substrate may be prepared and the major-diameter side of each bore may be located in the above-mentioned substrate side After sticking and arranging the above-mentioned metal mold on the front face of the above-mentioned substrate, it is filled up with a spacer formation ingredient in the bore of metal mold. Irradiate the above-mentioned spacer formation ingredient, make it harden a radiation, and the adhesion of the above-mentioned spacer formation ingredient to the front face of the above-mentioned substrate Where the above-mentioned metal mold is stuck to a substrate, the above-mentioned spacer formation ingredient is calcinated, it is made higher than the adhesion of the above-mentioned spacer formation ingredient to the above-mentioned metal mold, a spacer is formed in one on the above-mentioned substrate, respectively, and after cooling, it is characterized by exfoliating the above-mentioned metal mold from the above-mentioned substrate.

[0013] Moreover, the manufacture approach of other spacer assemblies concerning this invention A tabular grid with two or more spacer puncturing located between the above-mentioned convergence puncturing, respectively is prepared for the 1st and 2nd front faces and a list. So that the 1st tabular metal mold and the 2nd tabular metal mold with two or more bores of the shape of a taper with a stage to which the path became small gradually toward the other end side may be prepared from an end side, respectively and the major-diameter side of each bore may be located in the above-mentioned grid side The 1st metal mold of the above and the 2nd metal mold are stuck, respectively on the 1st front face of the above-mentioned grid, and the 2nd front face. And after arranging in the condition that spacer puncturing of the above-mentioned grid and the bore of the 1st and 2nd metal mold aligned, It is filled up with a spacer formation ingredient in the above-mentioned spacer puncturing and the bore of the 1st and 2nd metal mold. Irradiate the above-mentioned spacer formation ingredient, make it harden a radiation, and the adhesion of the above-mentioned spacer formation ingredient to the above-mentioned grid It is made higher than the adhesion of the spacer formation ingredient to the 1st and 2nd metal mold of the above. Where the 1st and 2nd metal mold of the above is stuck to a grid, the above-mentioned spacer formation ingredient is calcinated, a spacer is formed on the 1st and 2nd front faces of the above-mentioned grid, respectively, and after cooling, it is characterized by exfoliating the 1st and 2nd metal mold of the above from the above-mentioned grid.

[0014] Furthermore, the manufacture approach of other spacer assemblies concerning this invention Prepare a tabular grid with the 1st and 2nd front faces, and the 1st tabular metal mold and the 2nd tabular metal mold with many bores of the shape of a taper with a stage to which the path became small gradually toward the other end side are prepared from an end side, respectively. After sticking and arranging the 1st metal mold of the above on the 1st front face of the above-mentioned grid so that the major-diameter side of each bore may be located in the above-mentioned grid side, Are filled up with a spacer formation ingredient in the bore of the 1st metal mold, and irradiate the above-mentioned spacer formation ingredient and it is made to harden a radiation. So that adhesion of the above-mentioned spacer formation ingredient to the 1st front face of the above-mentioned grid may be made higher than the adhesion of the above-mentioned spacer formation ingredient to the 1st metal mold of the above and the major-diameter side of each bore may be located in the above-mentioned grid side After sticking and arranging the 2nd metal mold of the above on the 2nd front face of the above-mentioned grid, it is filled up with a spacer formation ingredient in the bore of the 2nd metal mold. Irradiate the above-mentioned spacer formation ingredient, make it harden a radiation, and the adhesion of the above-mentioned spacer formation ingredient to the 2nd front face to the above-mentioned grid It is made higher than the adhesion of the above-mentioned spacer formation ingredient to the 2nd metal mold of the above. After irradiating the above-mentioned radiation, where the 1st and 2nd metal mold of the above is stuck to a grid, the above-mentioned spacer formation ingredient is calcinated. A spacer is formed on the 1st and 2nd front faces of the above-mentioned grid, respectively, and after cooling, it is characterized by exfoliating the 1st and 2nd metal mold of the above from the above-mentioned substrate.

[0015] As the above-mentioned spacer formation ingredient, using the glass paste containing the binder and glass filler of an ultraviolet curing mold, ultraviolet rays are irradiated as a radiation in this case, and, according to this invention, a spacer formation ingredient is stiffened in the above-mentioned manufacture approach. Moreover, while convergence puncturing of the metal plate with which the oxide film was formed in the front face, and a large number is formed as the above-mentioned substrate, the grid which consists of a metal plate with which the oxide film was formed in the front face, or a glass substrate can be used.

[0016] According to the manufacture approach of the spacer assembly constituted as mentioned above, it becomes possible to make two or more spacers at once in the predetermined location on a substrate or a grid by calcinating a spacer formation ingredient in the condition of having arranged the spacer formation ingredient on a substrate or a grid using metal mold. Therefore, the spacer assembly equipped with two or more detailed spacers can be manufactured easily, and reduction of a manufacturing cost and improvement in manufacture effectiveness can be aimed at.

[0017] Moreover, it becomes possible at the time of baking for a spacer formation ingredient to be crushed, not to spread, to have sufficient height, and to form the high spacer of an aspect ratio easily by calcinating a spacer formation ingredient in the condition of having been filled up in the bore of metal mold.

[0018] Furthermore, while irradiating ultraviolet rays and stiffening a spacer formation ingredient in advance of baking using the glass paste which contained the binder and glass filler of an ultraviolet curing mold at least as a spacer formation ingredient, adhesion of the spacer formation ingredient to a substrate or a grid can be made higher than the adhesion over metal mold by using the metal mold covered with the surface layer with the grid and oxidation resistance which were covered with the oxide film. It can prevent that the formed spacer adheres to a metal mold side in future baking and a mold release process by this, and the spacer of a substrate or a grid, and one can be formed certainly.

[0019] The metal mold used for manufacture of the spacer assembly concerning this invention is equipped with the metallic thin plate of two or more sheets with which two or more taper-like bores were formed, respectively, each bore of each metallic thin plate has a different path from the bore of other metallic thin plates, and two or more above-mentioned metallic thin plates are characterized by carrying out the laminating in the condition of being in the condition where bores aligned, and having stood in a line sequentially from the big bore of a path.

[0020] According to the above-mentioned configuration, metal mold carries out the laminating of the metallic thin plate of two or more sheets with which the bore was formed, respectively, and is constituted, and each bore of metal mold accumulates two or more bores, and is specified. And in the case of a metallic thin plate, a detailed bore can be formed comparatively easily by etching, laser radiation, etc. Therefore, the metal mold which has the bore formed in request height can be easily obtained by carrying out the laminating of the metallic thin plate of two or more of these sheets.

[0021] Moreover, in the above-mentioned metal mold, while the bore formed in each metallic thin plate is making the shape of a taper, the path is different for every metallic thin plate. Therefore, even when carrying out the laminating

of the metallic thin plate of two or more of these sheets and a location gap of some arises, the bores of each metallic thin plate can be made to be able to open for free passage certainly, and metal mold with a desired bore can be obtained.

[0022] Furthermore, according to this invention, the above-mentioned metal mold is covered with the surface layer which had detachability to the spacer formation ingredient. Therefore, a spacer formation ingredient cannot adhere easily in the bore of metal mold, and it becomes possible to use it for manufacture of a spacer assembly repeatedly.

[0023]

[Embodiment of the Invention] This invention is explained to a detail about the gestalt of the operation applied to surface conduction mold electron emission equipment (SED is called hereafter) as a flat-surface display, referring to a drawing below. As shown in drawing 1 thru/or drawing 3, this SED is equipped with the rear plate 10 and face plate 12 which consist of rectangle-like glass, respectively, these plates place an about 1.5-3.0mm clearance, and opposite arrangement is carried out. The rear plate 10 is formed in the slightly bigger dimension than a face plate 12. And a periphery section comrade is joined through the side attachment wall 14 of the shape of a rectangle frame which consists of glass, and the rear plate 10 and the face plate 12 constitute the vacuum envelope 15 of the shape of a flat rectangle.

[0024] The fluorescent substance screen 16 is formed in the inside of a face plate 12. This fluorescent substance screen 16 puts red, blue, a green fluorescent substance layer, and a black coloring layer in order, and is constituted. These fluorescent substance layers are formed the shape of a stripe, and in the shape of a dot. Moreover, on the fluorescent substance screen 16, the metal back 17 who consists of aluminum etc. is formed. In addition, the transparence electric conduction film or color filter film which consists of ITO may be prepared between a face plate 12 and a fluorescent substance screen.

[0025] The electron emission component 18 of a large number which emit an electron beam, respectively is formed in the inside of the rear plate 10 as a source of electron emission which excites a fluorescent substance layer. These electron emission components 18 correspond for every pixel, and are arranged by two or more trains and the multi-line. Each electron emission component 18 consists of the electron emission section which is not illustrated, a component electrode of the pair which impresses an electrical potential difference to this electron emission section, etc. Moreover, on the rear plate 10, wiring of the a large number book which is not illustrated for impressing an electrical potential difference to the electron emission component 18 is prepared in the shape of matrix.

[0026] Sealing of the side attachment wall 14 which functions as joint material was carried out to the periphery section of the rear plate 10, and the periphery section of a face plate 12 with the frit glass 20 which consists of low melting glass, and it has joined the face plate and the rear plate comrade.

[0027] Moreover, SED is equipped with the spacer assembly 22 arranged between the rear plate 10 and the face plate 12 as shown in drawing 2 and drawing 3. In the gestalt of this operation, the spacer assembly 22 is equipped with the tabular grid 24 and the spacer of the shape of two or more column set up by both sides of a grid in one, and is constituted.

[0028] If it states to a detail, a grid 24 has 2nd surface 24b which countered the inside of 1st surface 24a which countered the inside of a face plate 12, and the rear plate 10, and is arranged at these plates and parallel. And much the convergence puncturing 26 and two or more spacer puncturing 28 are formed in the grid 24 of etching etc. While the convergence puncturing 26 counters the electron emission component 18, respectively and being arranged, the spacer puncturing 28 is located between convergence puncturing, respectively, and is arranged in the predetermined pitch.

[0029] The oxide film with which a grid 24 consists of an oxide film 3O4 which becomes the front face from the element which constitutes a metal plate while being formed in 0.1-0.25mm in thickness by the metal plate of an iron-nickel system, for example, Fe, and NiFe 3O4 is formed. Moreover, the convergence puncturing 26 is formed 0.15-0.25mmx0.20-0.40mm in the shape of a rectangle, and, as for the spacer puncturing 28, the path is formed in about 100-200 micrometers.

[0030] On 1st surface 24a of a grid 24, 1st spacer 30a was set up in piles by each spacer puncturing 28 in one, and the extension edge is in contact with the inside of a face plate 12 through the black coloring layer of the metal back 17 and the fluorescent substance screen 16. Moreover, on 2nd surface 24b of a grid 24, 2nd spacer 30b was set up in piles by each spacer puncturing 28 in one, and the extension edge is in contact with the inside of the rear plate 10. And each spacer puncturing 28 and the 1st and 2nd spacers 30a and 30b align mutually, it is located, and the 1st and 2nd spacers of each other are connected in one through this spacer puncturing 28.

[0031] It has in one two or more steps to which the path became small gradually while the laminating of each of the

1st and 2nd spacers 30a and 30b is carried out toward the extension edge from the grid 24 side, and each step is formed in the shape of [of a taper] a taper toward extension one end from the grid side. That is, each of the 1st and 2nd spacers 30a and 30b is formed in the taper configuration with a stage, or the truncated cone configuration with a stage.

[0032] For example, in a taper configuration with four steps of stages, the path of about 400 micrometers and extension one end is formed in about 230 micrometers, as for each 1st spacer 30a, height is formed in about 1-1.2mm for the path of the edge by the side of nothing and a grid 24, and the aspect ratio (path of height / grid side edge) has become 2.5-3.0. Moreover, in a taper configuration with three steps of stages, the path of about 400 micrometers and extension one end is formed in about 280 micrometers, as for each 2nd spacer 30b, height is formed in about 0.3-0.75mm for the path of the edge by the side of nothing and a grid 24, and the aspect ratio (path of height / grid side edge) has become 0.75-1.6.

[0033] As mentioned above, the path of each spacer puncturing 28 is about 100-200 micrometers, and is set up smaller enough than the path of the grid side edge of the 1st and 2nd spacers 30a and 30b. And by aligning in same axle with the spacer puncturing 28, and preparing 1st spacer 30a and 2nd spacer 30b in one, the 1st and 2nd spacers of each other are connected through spacer puncturing, and where a grid 24 is put from both sides, they are formed in a grid 24 and one.

[0034] And a predetermined electrical potential difference is impressed from the power source which is not illustrated, and the grid 24 of the spacer assembly 22 constituted as mentioned above is converged on the fluorescent substance layer of a request of the electron beam emitted from the electron emission component 18 which corresponds by each convergence puncturing 26 while it prevents a cross talk. Moreover, by contacting the inside of a face plate 12 and the rear plate 10, the 1st and 2nd spacers 30a and 30b support the atmospheric pressure load which acts on these plates, and are maintaining spacing between plates to the predetermined value.

[0035] Next, the manufacture approach of the spacer assembly 22 constituted as mentioned above and SED equipped with this is explained. When manufacturing the spacer assembly 22, as shown in drawing 4, the 1st and 2nd rectangle tabular metal mold 32 and 33 with the almost same dimension as the grid 24 of a predetermined dimension and a grid is prepared first. a grid 24 -- beforehand -- the convergence puncturing 26 and the spacer puncturing 28 -- forming -- the outside whole -- for example, melanism -- it covers with the oxide film which consists of film or a granular oxide.

[0036] Moreover, two or more bores 34 to which the 1st and 2nd metal mold 32 and 33 corresponded to the spacer puncturing 28 of a grid 24, respectively are formed. Here, as shown in drawing 5, the 1st metal mold 32 carries out the laminating of the metallic thin plates 32a, 32b, 32c, and 32d of two or more sheets, for example, four sheets, and is formed.

[0037] If it states to a detail, while each metallic thin plate consists of iron system metal plates with a thickness of 0.25-0.3mm, two or more taper-like bores are formed, respectively. And the bore formed in metallic thin plates [32a, 32b, 32c, and 32d] each has a different path from the bore formed in other metallic thin plates. For example, 34d of bores of the shape of a taper whose overall diameter is 240 micrometers is formed in bore 34c of the shape of a taper whose overall diameter is 295 micrometers, and 32d of metallic thin plates by metallic-thin-plate 32a at bore 34a of the shape of a taper whose overall diameter is 400 micrometers, and metallic-thin-plate 32b at bore 34b of the shape of a taper whose overall diameter is 350 micrometers, and metallic-thin-plate 32c, respectively. These bore 34a thru/or 34d are formed by etching or laser radiation.

[0038] And the laminating of the metallic thin plates 32a, 32b, 32c, and 32d of these four sheets is carried out in the condition of being in the condition where Bores 34a, 34b, 34c, and 34d aligned almost in same axle, and having stood in a line sequentially from the big bore of a path, and diffused junction is mutually carried out in the vacuum or the reducing atmosphere. Thereby, the 1st metal mold 32 with a thickness of 1.0-1.2mm is formed as a whole, and each bore 34 is prescribed by by doubling four bores 34a, 34b, 34c, and 34d, and has taper-like inner skin with a stage.

[0039] On the other hand, the laminating of the metallic thin plate of three sheets is carried out, and it is constituted, and the 2nd metal mold 33 is also prescribed by three taper-like bores, and, as for each bore 34, has taper-like inner skin with a stage. [as well as / for example, / the 1st metal mold 32]

[0040] Moreover, the external surface of the 1st and 2nd metal mold 32 and 33 is covered with the surface layer also including the inner skin of each bore 34. This surface layer has oxidation resistance while having detachability to the spacer formation ingredient mentioned later, for example, it is formed of eutectoid plating with eutectoid plating with nickel-P and the particle of Teflon (trademark), an oxide, a nitride, and carbide or nickel-P, and refractory metals, such as W, Mo, and Re.

[0041] In the production process of a spacer assembly, as shown in drawing 6 a, it arranges in the condition of having

positioned the 1st metal mold 32 so that the major-diameter side of each bore 34 might be located in a grid 24 side, it might be made sticking to 1st surface 24a of a grid and each bore might align with the spacer puncturing 28 of a grid. It arranges in the condition of similarly having positioned the 2nd metal mold 33 so that the major-diameter side of each bore 34 might be located in a grid 24 side, it might be made sticking to 2nd surface 24b of a grid and each bore might align with the spacer puncturing 28 of a grid. And it fixes mutually using the clamber which does not illustrate these 1st metal mold 32, a grid 24, and the 2nd metal mold 33.

[0042] Next, as shown in drawing 6 b, using a squeegee 36, the paste-like spacer formation ingredient 40 is supplied from the external surface side of the 1st metal mold 32, and the bore 34 of the 1st metal mold 32, the spacer puncturing 28 of a grid 24, and the bore 34 of the 2nd metal mold 33 are filled up with a spacer formation ingredient. The excessive spacer formation agent 40 leaked to the external surface side of the 2nd metal mold 33 is swept using a squeegee 38. As a spacer formation ingredient 40, the glass paste which contained the binder (organic component) and glass filler of an ultraviolet curing mold at least is used.

[0043] Then, as shown in drawing 6 c, to the spacer formation ingredient 40 with which it filled up, ultraviolet rays (UV) are irradiated as a radiation from the external surface side of the 1st and 2nd metal mold 32 and 33, and UV hardening of the spacer formation ingredient is carried out. Thus, by carrying out UV hardening of the spacer formation ingredient 40, adhesion of the spacer formation ingredient to a grid 24 is made higher than the adhesion of the spacer formation ingredient to the 1st and 2nd metal mold 32 and 33.

[0044] Then, as shown in drawing 7 a, after heat-treating these within a heating furnace where the 1st and 2nd metal mold 32 and 33 is stuck to a grid 24 and flying a binder from the inside of the spacer formation ingredient 40, actual baking of the spacer formation ingredient is carried out at about 500-550 degrees C for 30 minutes to 1 hour. This forms the 1st and 2nd spacers 30a and 30b of a grid 24 and one.

[0045] Then, after cooling the 1st and 2nd metal mold 32 and 33 and a grid 24 to predetermined temperature, as shown in drawing 7 b, the 1st and 2nd metal mold 32 and 33 is exfoliated from a grid 24. Thereby, the spacer assembly 22 is completed.

[0046] When manufacturing SED using the spacer assembly 22 manufactured as mentioned above, the rear plate 10 to which the side attachment wall 14 was beforehand joined while the electron emission component 18 was formed, and the face plate 12 with which the fluorescent substance screen 16 and the metal back 17 were formed are prepared. And where the spacer assembly 22 is positioned on the rear plate 10, this rear plate and face plate 12 are arranged in a vacuum chamber, and where evacuation of the inside of a vacuum chamber is carried out, a face plate 12 is joined to the rear plate 10 through a side attachment wall 14. Thereby, SED equipped with the spacer assembly 22 is manufactured.

[0047] While having in one two or more steps to which the path became small gradually while the laminating of each spacer was carried out toward the extension edge according to the spacer assembly 22 constituted as mentioned above and SED equipped with this, each step is making nothing and a taper configuration with a stage as a whole, i.e., a truncated cone configuration almost with a stage, for the shape of a taper of a taper toward extension one end. Therefore, it becomes possible to make two or more spacers in one on a grid by mold molding, and the spacer assembly and SED which can be manufactured can be obtained easily.

[0048] Moreover, according to the manufacture approach of the spacer assembly mentioned above, two or more spacers can be made at once in the predetermined location on a grid by calcinating a spacer formation ingredient in the condition of having arranged the spacer formation ingredient on a grid using metal mold. Therefore, the spacer assembly equipped with two or more detailed spacers can be manufactured easily, and reduction of a manufacturing cost and improvement in manufacture effectiveness can be aimed at.

[0049] Moreover, it becomes possible at the time of baking to form easily the high spacer of the aspect ratio which a spacer formation ingredient was crushed, did not spread and had sufficient height by calcinating a spacer formation ingredient in the condition of having been filled up in the bore of metal mold.

[0050] Furthermore, with the gestalt of this operation, while irradiating ultraviolet rays and stiffening a spacer formation ingredient in advance of baking using the glass paste which contained the binder and glass filler of an ultraviolet curing mold as a spacer formation ingredient, adhesion of the spacer formation ingredient to a grid can be made higher than the adhesion over metal mold by using the metal mold covered with the surface layer with the grid and oxidation resistance which were covered by the oxide film. It can prevent that the formed spacer adheres to a metal mold side in future baking and a mold release process by this, and the spacer of a grid and one can be formed certainly.

[0051] On the other hand, according to the gestalt of this operation, each metal mold carries out the laminating of the

metallic thin plate of two or more sheets with which the bore was formed, respectively, and is constituted. Usually, it becomes very difficult to form the detailed bore of 100 micrometers of parameters for spacer formation in the metal plate more than about 1mm thickness. On the other hand, if it is the metallic thin plate of about 0.1-0.3mm thickness extent, a detailed bore can be formed comparatively easily by etching, laser radiation, etc. Therefore, metal mold with the bore of request height can be easily obtained by carrying out the laminating of the metallic thin plate of two or more sheets with which the bore was formed like the gestalt of this operation.

[0052] Moreover, in the above-mentioned metal mold, while the bore formed in each metallic thin plate is making the shape of a taper, the path is different for every metallic thin plate. Therefore, even when carrying out the laminating of the metallic thin plate of two or more of these sheets and a location gap of some arises, the bores of each metallic thin plate can be made to be able to open for free passage certainly, and metal mold with a desired bore can be obtained. Furthermore, since the above-mentioned metal mold is covered with the surface layer which had detachability to the spacer formation ingredient, a spacer formation ingredient cannot adhere easily in the bore of metal mold, and it is repeatedly applicable to manufacture of a spacer assembly.

[0053] Next, SED equipped with the spacer assembly concerning the gestalt of implementation of the 2nd of this invention and its manufacture approach are explained. As shown in drawing 8, according to the gestalt of the 2nd operation, the grid 24 of the spacer assembly 22 does not have spacer puncturing, but the 1st and 2nd spacers 30a and 30b are formed independently in one with the grid 24, respectively.

[0054] That is, two or more 1st spacer 30a was set up between the convergence puncturing 26 on 1st surface 24a of a grid 24, and is in contact with the inside of a face plate 12 through the black coloring layer of the metal back 17 and the fluorescent substance screen 16. Moreover, two or more 2nd spacer 30b is set up between the convergence puncturing 26 on 2nd surface 24b of a grid 24, and it aligns with 1st spacer 30a, respectively, and it is arranged while it is in contact with the inside of the rear plate 10. Other configurations are the same as that of SED in the gestalt of the 1st operation mentioned above, give the same reference mark to the same part, and omit the detailed explanation.

[0055] First, the 1st metal mold 32 is stuck to 1st surface 24a of a grid, and when manufacturing the spacer assembly 22 of the above-mentioned configuration, as shown in drawing 9 a, it is positioned so that each bore may be located between the convergence puncturing 26 of a grid, so that the major-diameter side of each bore 34 may be located in a grid 24 side. Then, using a squeegee 36, the paste-like spacer formation ingredient 40 is supplied from the external surface side of the 1st metal mold 32, and the bore 34 of the 1st metal mold 32 is filled up with a spacer formation ingredient. In addition, the spacer formation ingredient 40 and the 1st metal mold 32 use the same thing as the gestalt of operation mentioned above.

[0056] Next, as shown in drawing 9 b, to the spacer formation ingredient 40 with which the bore 34 was filled up, ultraviolet rays (UV) are irradiated from the external surface side of the 1st metal mold 32, and UV hardening of the spacer formation ingredient is carried out. Thereby, adhesion of the spacer formation ingredient 40 to a grid 24 is made higher than the adhesion of the spacer formation ingredient to the 1st metal mold 32.

[0057] Then, holding a grid 24 and the 1st metal mold 32 in the adhesion condition, as shown in drawing 10 a, the 2nd metal mold 33 is stuck to 2nd surface 24b of a grid, and it is positioned so that each bore may be located between the convergence puncturing 26 of a grid, so that the major-diameter side of each bore 34 may be located in a grid 24 side. And it fixes mutually using the clamber which does not illustrate these 1st metal mold 32, a grid 24, and the 2nd metal mold 33.

[0058] Then, using a squeegee 36, the paste-like spacer formation ingredient 40 is supplied from the external surface side of the 2nd metal mold 33, and the bore 34 of the 2nd metal mold 33 is filled up with a spacer formation ingredient. In addition, the 2nd metal mold 33 uses the same thing as the gestalt of operation mentioned above.

[0059] Then, as shown in drawing 10 b, to the spacer formation ingredient 40 with which the bore 34 was filled up, ultraviolet rays are irradiated from the external surface side of the 2nd metal mold 33, and UV hardening of the spacer formation ingredient is carried out. Thereby, adhesion of the spacer formation ingredient 40 to a grid 24 is made higher than the adhesion of the spacer formation ingredient to the 2nd metal mold 32.

[0060] Then, as shown in drawing 10 c, after heat-treating these within a heating furnace where the 1st and 2nd metal mold 32 and 33 is stuck to a grid 24 and flying a binder from the inside of the spacer formation ingredient 40, actual baking of the spacer formation ingredient is carried out at about 500-550 degrees C for 30 minutes to 1 hour. This forms the 1st and 2nd spacers 30a and 30b of a grid 24 and one.

[0061] And after cooling the 1st and 2nd metal mold 32 and 33 and a grid 24 to predetermined temperature, the spacer assembly 22 is completed by exfoliating the 1st and 2nd metal mold 32 and 33 from a grid 24. Moreover, manufacture of SED equipped with the spacer assembly 22 of the above-mentioned configuration is performed at the

same process as the gestalt of operation mentioned above. The same operation effectiveness as the gestalt of operation which was constituted as mentioned above and which was mentioned above also in the gestalt of the 2nd operation can be acquired.

[0062] In addition, in the gestalt of the 1st mentioned above and the 2nd operation, although the spacer assembly was considered as the configuration which equipped both sides of a grid 24 with the 1st and 2nd spacers respectively in one, it is good also as a configuration which is shown in drawing 11 and which formed the spacer only on one front face of a grid like the gestalt of the 3rd operation.

[0063] That is, according to the gestalt of the 3rd operation, the spacer assembly 22 has a grid 24 and two or more 1st spacer 30a set up by 1st surface 24a of a grid in one. Such 1st spacer 30a was set up between the convergence puncturing 26, and is in contact with the inside of a face plate 12 through the black coloring layer of the metal back 17 and the fluorescent substance screen 16.

[0064] On the other hand, on the inside of the rear plate 12, two or more 2nd spacer 30b was set up in one, and while aligning with 1st spacer 30a, respectively and being located, it is in contact with 2nd surface 24b of a grid 24.

[0065] In addition, the 1st and 2nd spacers 30a and 30b are formed in the taper configuration with a stage formed in the taper toward the extension edge, respectively, i.e., a truncated cone configuration with a stage, like the gestalt of operation mentioned above. Moreover, other configurations of SED are the same as the configuration of operation mentioned above, give the same reference mark to the same part, and omit the detailed explanation.

[0066] In the gestalt of the 3rd operation, the spacer assembly 22 is manufactured by the same approach as the gestalt of the 2nd operation mentioned above. However, the production process of the 2nd spacer omits. Moreover, in the gestalt of the 3rd operation, two or more 2nd spacer 30b constitutes other spacer assembly 22b with the glass substrate which constitutes the rear plate 12. And this spacer assembly 22b is also manufactured by the same approach as the gestalt of the 2nd operation.

[0067] That is, it replaces with a grid, and the 2nd metal mold 33 mentioned above on the front face of the rear plate 10 which consists of a glass substrate is stuck so that the major-diameter side of each bore 34 may be located in a rear plate side, and it is positioned in a predetermined location. Then, a paste-like spacer formation ingredient is supplied from the external surface side of the 2nd metal mold 33, and the bore 34 of the 2nd metal mold is filled up with a spacer formation ingredient. A spacer formation ingredient uses the same thing as the gestalt of operation mentioned above.

[0068] Next, ultraviolet rays are irradiated at the spacer formation ingredient with which the bore was filled up, and UV hardening of the spacer formation ingredient is carried out. Thereby, adhesion of the spacer formation ingredient to the rear plate 10 is made higher than the adhesion of the spacer formation ingredient to the 2nd metal mold 33. Here, since itself is an oxide, the glass substrate which constitutes the rear plate 10 does not need to form an oxide film in rear plate external surface.

[0069] Then, after heat-treating these within a heating furnace where the 2nd metal mold 33 is stuck on the rear plate 10, and flying a binder from the inside of a spacer formation ingredient, actual baking of the spacer formation ingredient is carried out. This forms 2nd spacer 30b of the rear plate 10 and one.

[0070] And after cooling the 2nd metal mold 33 and the rear plate 10 to predetermined temperature, spacer assembly 22b which equipped one with the rear plate 10 and 2nd spacer 30b is completed by exfoliating the 2nd metal mold 33. The same operation effectiveness as the gestalt of other operations which was constituted as mentioned above and which was mentioned above also in the gestalt of the 3rd operation can be acquired.

[0071] In addition, this invention is variously deformable within the limits of this invention, without being limited to the gestalt of operation mentioned above. For example, the spacer formation ingredient is selectable suitably not only the glass paste mentioned above but if needed. Moreover, the path of a spacer, height, the dimension of other components, the quality of the material, etc. are selectable suitably if needed. Moreover, the metallic thin plate which constitutes metal mold may be mutually joined not only by diffused junction but by soldering, ultrasonic jointing, etc.

[0072] With the gestalt of operation mentioned above, after sticking metal mold to a grid or a glass substrate, it considered as the configuration which fills up the bore of metal mold with a spacer formation ingredient, but after filling up the bore of metal mold with a spacer formation ingredient beforehand, it is good also as a configuration which is made to stick metal mold to a grid or a glass substrate, and arranges it.

[0073] Furthermore, without being limited to SED mentioned above, if this invention is the flat-surface display equipped with the spacer, it can be applied to various things. Moreover, as the gestalt of implementation of the above 3rd showed, this invention is applicable not only to the spacer assembly equipped with the grid but the spacer assembly equipped with a metal substrate without convergence puncturing or a glass substrate, and two or more

spacers, flat-surface displays, and these manufacture approaches.

[0074]

[Effect of the Invention] As explained in full detail above, according to this invention, the metal mold easily used for the manufacture approach of the spacer assembly for flat-surface indicating equipments which can be manufactured, the flat-surface indicating equipment equipped with this, and a spacer assembly, and manufacture of a spacer assembly can be offered.

[Translation done.]